

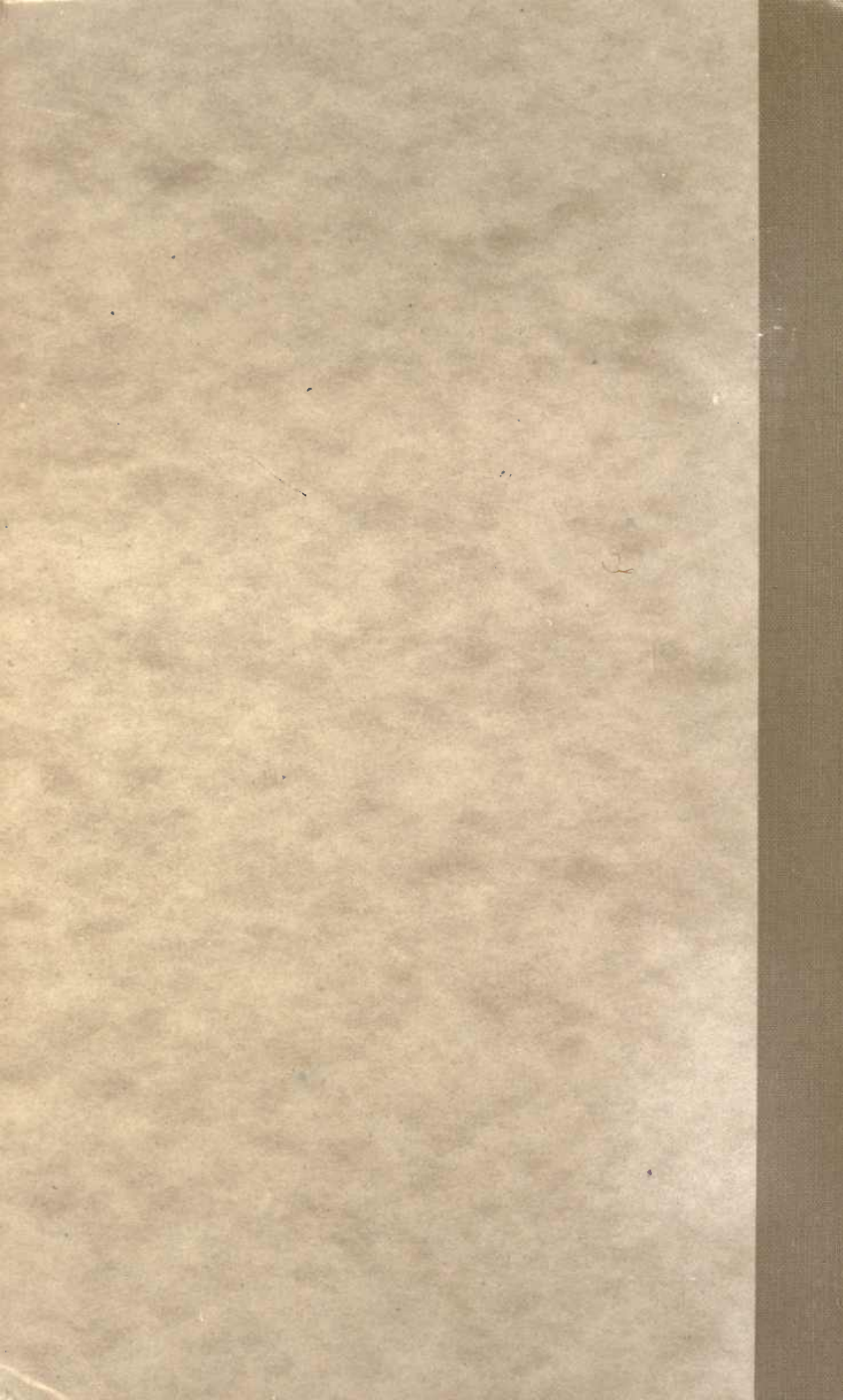
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Prof. John B. Trask's report on the
geology of the Sierra Nevada.

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IN THE ASSEMBLY.]

SESSION OF 1853.

PROF. JOHN B. TRASK'S REPORT

ON THE

GEOLOGY

OF THE

SIERRA NEVADA, OR CALIFORNIA RANGE.

[GEORGE KERR, STATE PRINTER.

1000 cop printed

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CHAPMAN

R E P O R T .

MR. PRESIDENT :

The Committee, to whom was referred the resolutions calling on Mr. Trask for such information as he may possess relative to the Geology of this State, beg leave to Report—

That they have obtained a valuable document, which treats of the Geological, and Mineralogical structure and character of some of the most interesting portions of our country.

The document, which we here present, is well worthy the consideration, not only of every member of this Legislature, but our citizens generally.

The General Government has been very dilatory in reference to such surveys and examinations as our State not only deserves, but is entitled to.

And in obtaining the information which is now placed in the hands of this Senate, we hope that the subject will attract the attention of those most interested in the development of the resources of this country.

We, therefore, recommend that 2000 copies of the report be printed, and request the Governor to forward several copies of the report and resolutions to the Secretary of the Interior of the United States, hoping that this method will draw the attention of the Honorable Secretary to the subject of a Geological and Mineralogical Survey of this State.

J. R. SNYDER,
Chairman of Committee.
JOS. WALKUP,
J. H. WADE.

Whereas, Any information connected with the Geology of this State, is of great importance not only to the miner, but to the *agriculturalist*, and as an

opportunity is now offered through Dr. Trask, (a gentleman who has made a thorough examination of the mineral districts,) by which we may add to the very limited stock of knowledge upon that subject ; *therefore*,

Resolved, That a Select Committee of five be appointed to obtain from Dr. Trask such information as he may possess relative to the subject, which if deemed of sufficient importance, will be reported to the Senate on the sixth day of April next.

GEOLOGICAL REPORT.

*To the Honorable J. R. Snyder, Chairman
of the Committee on the Geology of the State :*

SIR :

In compliance with the resolution of the Senate of the State of California, passed March 26th, 1853, calling upon me for such information in relation to the Geology of the State, as I may possess, I have the honor to transmit herewith the following report on the Geology, and productive resources of the State, that have fallen within the line of my reconnoissances, which line is embraced within the 36th and 42d degrees of north latitude.

JOHN B. TRASK.

GEOLOGICAL REPORT
P. B. F. A. E.

To the Honorable J. R. Snyder, Chairman

The following report was prepared by the
Geological Survey of the State of California
under the direction of the Honorable
J. R. Snyder, Chairman, and the Honorable
J. B. F. A. E., Secretary, of the
Board of Geographical Names, and
the Honorable J. B. F. A. E., Secretary,
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P R E F A C E .

THE object of this report is to present, in a concise manner, a sketch of the Geological Structure, Industrial and Economic Resources of the State, included in the above section named, and which comprises the Mineral Districts proper, as understood at the present time, and includes portions of the eastern valleys of the Sacramento and San Joaquin, and to the coast line within the 41st and 42d degrees of north latitude.

Personal observations were made during the autumn and winter of '50 and '51, and also of '52, and the entire line of travel was conducted for the most part on foot, for the better purpose of more critical examination.

Persons unfamiliar with the modifying circumstances affecting the general characters and positions of rocks, are apt to be often deceived in their perceptions respecting them, consequently, but little assistance can generally be obtained by inquiry respecting the peculiarities that may be present in the various formations.

This circumstance is sufficient to show the necessity of personal examination of Districts, in order to deduct legitimate and correct conclusions respecting them; and this course was adopted during the examinations that were made in nearly every case. In the remarks that follow in this report, I shall confine myself for the most part, strictly to the Geology of the District included, alluding to its Geognosy so far only as will be necessary for an elucidation of the subject that may be under consideration.

Researches on the eastern slope of the Rocky Mountain chain will prove of little avail in this State, as we cannot form an opinion from the presentations there made in the various and similar formations of that chain, and more especially, when we find that these similar formations are commingled, disturbed, and changed, by rocks of widely different character and composition.

The necessity then, of studying closely each different group, will become apparent, and at the same time more complex and difficult.

G E O L O G Y

OF THE

SIERRA NEVADA, OR CALIFORNIA RANGE.

THE largest portion of the State of California, is comprised between the summits of two distinct ranges of Mountains, denominated the Sierra Nevada, or California Range of the Cascades,* and the Coast Range on the west, the more central portion is an extensive valley through which flows the two principal rivers of the country, the Sacramento and San Joaquin.

The equivalents of the California Range to the north, are the Cascades extending into Oregon; and its principal lateral spurs, as it approximates the parallel of 42d north latitude, is found in the Siskiyou Range, which separates from the Cascades at nearly a right angle near the line of 42° 20', and pursues a tortuous course to within some eight miles of the coast, in about latitude 41° 40' north, at which point it becomes completely merged in the coast line of mountains.

This spur forms the northern boundary of the Klamath river, as also a large portion of the northern boundary of the State; and which, with its lateral spurs, forms an interesting and important feature of this portion of the country.

The principal lateral spur of this range is given off near the line of 122° 50' west longitude, and pursues a southwest course for sixty or seventy miles, and unites with a similar spur some eight or ten miles south of Mt. Shasta, which has its intersection with the main Siskiyou Mountains in longitude near 123° west; the Klamath river cuts these two spurs near both of the points designated. Within the triangular space formed by this junction, are extensive valleys, as the Scott and Shasta illustrate.

The Siskiyou range will maintain an average elevation nearly equivalent

* Sierra Nevada is inappropriate, according to Lieut. Wilkes' U. S. Ex. Ex., as it blends the principal with part of another.

to the *Cascade range* for a large portion of its course, and an elevation superior by at least one-third to the Sierra Nevada, within the same parallel.

The highest portion of the range being found in Mount Shasta and Mount Read, within fifty miles of the coast.

These mountains partake, in a great measure, of the general characteristics of the Sierra, but in some points they vary in a material degree. In this particular, they become the more interesting, from the variability of the mineral characteristics which they present, and the prospective of other sources of wealth and economy which no part of the western flank of the Sierra presents. And allusion will be made to these points under their appropriate heads.

Mr. Tyson, in speaking of the California Range, very properly remarks, that "in Geological structure the Sierra Nevada resembles the Andes," and the analogy also holds good in being like the Andes, one great ridge, instead of a chain of ridges, such as constitute the Appalachian Range, and it is to this chain on the Pacific that we can look with any hope of success to the development of that article of great economic value, so necessary to the convenience and necessities of the growing wants of our State—mineral coal.

The altitude of the Sierra has been variously estimated, but its average height is probably within six thousand feet; while the coast range proper will not attain an altitude that will much exceed three thousand feet throughout its extent.

The formations which compose, for the most part, the western flank of the Sierra, are hypogene (volcanic) and metamorphic (changed) rocks; as these make up the greater part of the range, it must not be inferred (as has been done) that, from their similarity of composition, that their upheaval was simultaneous, for the strongest evidences exist that it was far otherwise.

In this, as in all other volcanic districts, there was undoubtedly long periods of quiescence—or a state, to say the least, that was comparatively quiet, occupying long intervals between the disturbing forces that were instrumental in developing this portion of the continent. The time that elapsed during the successive periods of elevation which have occurred, is beyond our utmost conception, and we arrive at the fact only through the medium of analogy.

But although there are periods in our geological history that exceed our utmost comprehension, still there are some evidences that disturbances have occurred at a comparatively recent date, even perhaps during the historic period: but this subject will again be alluded to in the sequel.¶

The characteristics of the volcanic rocks of our mountains are in most cases very uniform, but where discrepant features do arise in the hypogene or metamorphic rocks, it will often be found that local circumstances have exerted a great influence often in those modifications.

In illustration of this we will cite an instance. It is well known that talcose rocks form a large proportion of the aggregate of the plutonic series of this State. They are found in close proximity with the primary calcareous formation in many cases; in other instances, miles distant from the calcareous rocks.

It is a well known fact that intrusive dikes of trap, in passing through limestone, will change the calcareous formation to true talcose rocks;* and

* McCulloch.

this occurs in many instances within this State. Hence, we see that a lead of limestone may, under favorable circumstances, be made to assume the form of a volcanic rock, of which the talcose series is a member, and, as here shown, is also metamorphic.

This fact should always be kept in view in forming our conclusion in relation to any section of the mineral districts that may be under consideration, as injury and pecuniary loss would often be sustained in too hasty generalizations on a class of rocks so important as the talcose series of this county, as a source of wealth.

There can be but little doubt that the southern section of the country was in a state of disturbance long after the more northern section sunk into repose, and that for many ages volcanic fires exerted a wide and powerful influence throughout that district long after its emergence. As these fires died out, a long period of repose followed during which the land became inhabited by mamalians of various character and species, some of which were of mammoth size, as their relics at the present day attest.

During the age that these huge quadrupeds held their uninterrupted sway throughout the land, which was during the tertiary epoch, another convulsion which fully equaled the former, occurred, and through its fiery ravages swept from existence the entire race that occupied its surface and inhumed their remains beneath its scalding flood. Ages have since rolled by, and it was left for the toiling and industrious miner in his daily avocations to exhume from the bosom of the earth these scattered vestiges of the wreck of former ages.

We find the most ample evidence of this state of things after passing the Cosumnes river and as far south as the Tuolumne, beyond which as yet no vestige of these animals have been found.

From all the attendant circumstances it appears that during the period of repose, a large portion of the southern district was covered by water, (probably fresh,) in the form of lakes, and that these animals inhabited their borders. Their remains are found in the diluvial drift at the depth of ten to twenty feet below the surface, and this is covered in most part by a volcanic tufa, the product of recent volcanic action.

The other fossils which have been found in these districts are such only as occur among primary limestone and consist of algae, (a sea weed of the lowest order,) which leads us to the conclusion that the rocks which now form the dry land of the interior were formerly submerged beneath the ocean, and have been elevated to their present position through volcanic agency exerted through long and successive periods.

The district of country between the Cosumnes river and the 40th degree of north latitude, has strong evidence of having been the first that emerged from the ocean, but though the primary section, it presents most indubitable traces of subsequent rupture; it probably occurred during those periods when the south was in a state of extreme activity, and must have played an important part in modifying the contour of the country.

These subsequent changes have undoubtedly been much less violent than they otherwise would have been from the opening of two volcanic vents in the northern section near the head waters of Feather river, and in the summit proper west of Noble's pass. One of these was in action January, 1850, and discharged a current of lava which had not cooled in 1852.*

* Seen also by D r. Wozeneraft.

The evidence of subsequent disturbance was proved beyond a doubt, by the examination of many of our quartz veins. The occurrence of what is termed the slickensides in many of these veins, affords us the data on which to found such a conclusion.

The polished surfaces of these veins for scores of feet in extent, not only indicate the fact of this disturbance, but the striated surfaces point most indubitably to its course and direction. These stria and slickensides may be seen at Union Town, El Dorado county, in the Marthenus mine, to great advantage; also at Washington and Georgia mines, Quartzburg, Mariposa county.

The district of country lying north of the 40th degree of north latitude, much resembles in some particulars portions of the south; but it presents withal strong evidences of greater antiquity than the southern, in many of its parts; and portions of it were probably contemporaneous with the district south of forty degrees, although there is no probability that all of that section can claim contemporaneous origin, for if it did, its formations should in some degree correspond; whereas on examination, we find discrepancies that would seem to warrant us in referring them to another period.

A convenient way, then, would be the arrangement of the mineral district into three classifications, making in these such subdivisions as may be necessary, and under this plan they would present themselves in the following order:

First—Primary or central districts, included between latitude $38^{\circ} 30'$ and 40° north.

Second—The northern district, included between 40° and 42° north.

Third—The southern district, included between $38^{\circ} 30'$ and 36° north latitude.

I feel fully confident that whenever this State shall be authoritively examined, that a similar arrangement will be made, both for convenience and elucidation.

Under this arrangement, then, I shall speak of the various districts in the order in which they occur.

FIRST PRIMARY DISTRICT.

This name may be applied to this section with strict propriety; first, from the character of its rocks, and secondly from their distribution and association.

The rocks that compose this district are for the most part primitive, in a geological sense, being composed of granite, porphyry, trap, and other allied rocks, among which the serpentines form no unimportant part.

The rock that first emerged was undoubtedly the granite, which was ejected from beneath and protruded through the slate, and in many instances presents all the appearances of having flowed over the sedimentary formations; in other cases it is protruded as a single dike, often of miles extent, with lateral veins extending into the adjoining rocks.

There is every reason for this supposition being correct, and but one illustration will be necessary in elucidating it. It is found on examination that the *older* granite, which forms by far the largest part of this

formation, is cut through and disturbed by almost every other intrusive rock, while of itself it cuts through none, except the older argillaceous slates, which are of aqueous origin.

It must not be understood by this, that all the granites of the State are of this class, for it is far otherwise, as we have full three distinct series of rock in this country, with corresponding ages; and each of the other two have been instrumental in a great degree, in causing the disturbances observable in the primary formations.

Next to the granite, in the primary district, the trapean rocks form an important feature in the character of the country, and occupy a much larger area.

They are composed principally of the greenstone, trachytes, basalt, and porphyries, and it is to the intrusion of this group, that the uneven and rough features of the country are attributable in a great measure, and are interesting in a geological point of view, and would in a more elaborate report, demand more attention than our present limits will permit. Allusion to their effect on other rocks will be made under the head of mining.

The next class that claims our attention is the metamorphic (changed) rocks, many of which through agency of volcanic heat have become true porphyries; they are largely developed on the banks of the rivers of the country, and a great source of annoyance to miners engaged in river mining, as they are extremely tough and difficult to break.

Closely associated with these are occasionally veins of the original clay slate, from which these porphyries have been formed, holding different grades of induration, passing from a fissile clay slate into a compact rock, often in the distance of a few yards.

The serpentine rocks are the next in order of the volcanic group; they are generally intrusive rocks, and are widely distributed throughout the country, and many of them present distinct lines of stratification. They have received different names from the different forms they assume; some of them being true shales, of various thickness, consistency and composition. But all of them, in whatever form they may be found, have but the one origin, (volcanic,) though they may receive many modifications from subsequent causes.

These rocks, when found in the form of slates particularly, are entitled to more consideration than has been bestowed upon them by the mining community, as repositories of the precious metals.

It is to this class of rocks that we are in a great measure indebted for those valuable deposits of gold which the slate contains, as well, also, as the auriferous quartz veins with which they are so frequently combined. It was on these rocks that one of the greatest geologists (Mr. Dana) of the age based his opinion on the probable value of this State as an auriferous district long before the discovery of gold, and subsequent time has demonstrated how correct and just were his opinions; and yet public opinion, even at this time, has neglected to take cognizance of this class of rocks, so far only as accidental circumstances have thrown them in their way. I think that no hazard would be incurred by expressing the opinion that this class of rocks will be found, in many cases, the prolific sources of wealth in the future, equalled only by the auriferous quartz, and excelled by none. This class of rocks, or those known by the name of chlorite, which is but a

variety of this group, is represented in Mariposa County, at the locality known as Bear Valley; and a sufficient illustration of its value, will be found in the excitement that prevailed on its discovery. Moccasin Creek, four miles south of Stevenson's Bar, Tuolumne County, and river, is also another point at which they may be studied with advantage.

This is but two of many instances in which the auriferous deposits have been developed in this class of rocks; and when found, it is as much an integral of the formation containing it, as the thread of gold that permeates the vein of quartz.

In addition to its containing gold, as an integral part, when unassociated with the veins of quartz, it frequently becomes the retaining medium of this metal when in contact with those veins. Hence has arisen much loss to parties who have engaged in that later branch of industrial employment, from the neglect of attention to this important point: but we shall advert to this point more particularly when the subject of Quartz Mining engages our attention.

The sedimentary rocks of this district are of three kinds: 1st—Argelite Slates, (clay slate;) 2d—Conglomerates, (pudding stone;) 3d—Sand Stone: the two last occupying the smallest area.

The sandstone formation is evidently the most recent of this group, and in some parts of this district is fossiliferous,—this being the only point of importance attached to it, and this only in a scientific point of view, as a matter of economy or practical interest it will not, therefore, claim our further attention.

The principal localities in which it is found to contain imbedded fossils, are upon the Butte and Chico Creeks, and near Rich and Reeve's Bars on the first named creek, and the fossils are of the *Miocene* period, and the bed of sand stone rests on a metamorphosed slate, which is in some parts porphyritic.

The argelite rocks of the district, will command more of our attention than either of the other members of this group; first, from its superiority as a member of the group, though it is inferior as to position. The degradation of those rocks, form an important feature in the characteristics of the valley bottoms, and a sparsity or surplus of its debris, would, as a consequence, enhance or diminish the capabilities of the soil for agriculture; hence an attentive examination of the valley sections is imperatively demanded, in order to form a correct estimate of the capabilities of the soil in the great branch of national wealth, and prosperity—agriculture.

When the necessary examinations are instituted to develop this desirable end, we shall find that those portions of the valleys that are for six months of the year a semi-desert, and unfit for the habitation of man or beast, can be made, by the use of proper measures, to produce the cereals in as great abundance and profit as other localities, apparently, more favorably situated. Under the head of agriculture, this part of our subject will be more fully considered.

The distribution of this series from the foot hills to near the summit of the range, is but a proof of the influence it has, and still exerts in modifying the general characteristics of the country. Its universality throughout the mining sections, either *in situ* or in the form of debris, points to the important part it has played by the retentive principle it contains in preventing the

wider dispersion of the golden deposits of our hills and rivers; and it has been suggested, within the past year, that a large portion of this group will, at some future day, be mined for the gold they contain, mechanically, as well as other rocks that contain this metal as an integral. How soon this may take place, it would be improper to suppose at this time, but the premises on which the suggestion is based, are tenable.

The conglomerates of this district will next be considered. These rocks toward the valley appear to be co-extensive with the argelite, and from their position, it is inferred that their formation was posterior to the slates; in the more mountainous districts they appear in isolated masses, and in small patches, rendering their study less certain. In the lower foot-hills, in many places, the group in *situ* is wanting, and in its place low rolling gravelly hills are the only vestiges that mark the localities it formerly occupied. The causes of this absence in the group is found in the outcrop of heavy masses of trapean rock near the borders of the valley in these sections.

These older conglomerates have but little interest connected with them, further than geological position is concerned, except the modifying influence they exert through their debris on the formation of the valley sections; but there is a belt of these rocks in other parts of the country that will be entitled to much more and particular consideration.

Having now described the principal rocks of the primary district, we will now pass to the consideration of the rocks of the northern district. To avoid repetition, in our subject, in relation to its rocks, we will now state that in addition to those noticed in the primary, the northern section contains some few that should command attention in an economic view, so far as relates more particularly to their prospective value.

The first of these rocks that will claim our attention, is a hard silicious rock known by the common name of mill-stone, but in technical language *Buhr-stone*. This rock abounds on the Pitt river in large quantities, and also on to the north of Goose Lake, its admirable adaptation to milling requires no comment. The value of this rock cannot be too highly esteemed in this State, where the prospective is so flattering of its becoming a grain growing country, equalled by few on the Atlantic slope. The heavy expenses that are now incurred, and the future wants of the State in this particular will be obviated, and our dependent condition on foreign import destroyed. These rocks have, as yet, attracted little notice, but the rapidly increasing wants of the State will ere long bring them into requisition. In addition to the buhr-stone of this district, this section of the country contains some few traces of the secondary rocks, a suite almost entirely wanting, with this exception, in this country, so far as at present explored.

The existence of any portion of this suite should command our every attention, and any measure that will be likely to develop this formation, or any part of it within the limits of this State, should meet the approbation and support of the community at large. The importance attached to this group, at the present time in this country, is found in the fact, that it is to this suite that we must look for a home supply of the mineral coals, if ever found within the limits of our State.

As these rocks, (in form of secondary conglomerate,) have exhibited themselves in the northern districts, and in those parts of the section most immediately connected with the coast line of mountains, it is to be hoped

that judicious explorations in that range may develop its existence, either near those points alluded to, or in other and more distant parts of the range.

From the structure of the country, it is to be doubted whether any other position than the above named, presents the slightest ground for hope that this necessary material of comfort and economy will be found in other parts than those indicated; every effort, then, compatible with prudence should be made that will tend to elicit information on this important topic.

The frequent discovery of small patches of the mineral coal in those mountains, would seem to lend aid to the suggestion that its development in this range may be looked for with more confidence than at any other points, and a judiciously conducted examination is the only means that can be confidently looked to for this desirable end.

Aside from the two points alluded to, the northern district comports itself in the major part of its formations with the primary district, and varies from it only in a few minor particulars noticed in the sequel.

SOUTHERN DISTRICT.

This district, according to our arrangement, is included within the thirty-sixth parallel and thirty-eighth degrees thirty minutes north latitude, and includes all that portion of the country denominated the Southern Mines, as well, also, as its valleys. The southern district, like the other two, contains many rocks in common.

In addition to these, there are also other formations, which differ widely from either of the other districts, which we shall notice in the same manner as heretofore, as our limits will not permit otherwise.

The first that will claim our attention will be the principal volcanic rocks, and among these the basaltic rocks will find the first place. It has been observed that the northern and primary districts contained these rocks, and it must now be noticed that the southern section contain them in a preeminent degree, compared to either of the others. Their principal northern outcrop commences near the sources of the Mokelumne, and extend almost uninterrupted for seventy or eighty miles south, having a mean breadth of ten to fifteen miles, and frequently extending much farther to the west, even to the foot-hills in some cases. The hills on the borders of the valley west of the Bear Mountains, Calaveras County, furnish an instance.

These rocks are well developed about the region of Bear Valley, Mariposa County, on the ridge to the east of this locality. At this place they may be found in several of the forms they assume,—as the dolorite amygdaloid, columnar basalt and greenstone.

The effects of such large masses of volcanic rocks on the sedimentary formations through which they have protruded has been great, as would naturally suggest itself, and we find many of those formations completely metamorphosed, as might be anticipated. The rocks are entitled to consideration in two points, particularly. One is the results that are likely to ensue from the passage of these rocks through the sedimentary formation, and is the production or development of mineral veins, consisting, most commonly, of the metals copper, silver, &c. It is generally true that these

are most abundant in the older system of rocks, but this is not always the case.

By close examination of the mining districts of the world, our best geologists have announced the fact, that rich metallic districts are dependant on the proximity of igneous rocks and axes of disturbance among sedimentary formations, and every subsequent observation has tended to confirm this theory.

On comparing metallic accumulations among the igneous rocks, it is found they are most abundant in the underlying porphyries, amygdaloids and trap rock, as well also the syncinites. This condition, and the probable value of these rocks as a future source of wealth, will be fully comprehended when we observe that the metalliferous regions of the Andes are of this same character, and the outbursts of trap through its tertiary formations, are but a simple illustration of the condition of our own.

The second point of general importance, in relation to these rocks, is their value in modifying, from their composition, other earths with which they may be combined. Too much importance cannot be attached to this point, for it is through this agency that a large portion of our soil is rendered valuable for agriculture, and I hope I may not be charged with sectional feeling when I say, that in this lies one of the grand secrets of the superiority of the bottoms of the southern sections, coupled with the debris of the calcareous formations which also lie to the east of these valleys.

The next important volcanic products that will claim our attention is the large extent of volcanic tufa that covers superficially an extensive area of country in its aggregate.

This tufaceous deposit becomes most fully defined as an overflowing mass on the ridge that forms the south bank of the Mokelumne, and is found in nearly all the districts to the east and south as far as the Stanislaus. It was very properly denominated a volcanic breccia by Mr. Tyson, on the first named ridge, though in other sections it loses this character. This deposit covers the diluvial drift in many places, as well also the large mammalian remains that have been exhumed within the last two years. It is interesting and important, as it points to volcanic action at a comparatively recent date.

Since its deposit, strong floods have operated in these sections, (which were probably pent up waters, forming lakes in the interior,) as the outliers of the surrounding hills fully indicate, as well also as the extensive table-lands that formed its shores. The towns of Vallecito, Murphy's, Douglass' Flat, and the vicinity of Sonora, furnish most admirable examples of the former existence of lakes in these sections. This tufa overlies the drift that contains the auriferous deposit of these placers, to the depth, in some cases, of one hundred feet, and even greater.

Primary Lime-stone.—Notice of this rock has been deferred until this time, from the fact that it occupies a much greater area in the southern sections. Its extent may be said to be included between the American and Merced rivers, and following a line deflected but a few degrees from the parallelism of the chain, this line is not continuous, but is broken at short intervals, at times by the intrusions of volcanic rocks, at others being covered by alluvion in common with the covering of the hills.

Its situation appears to be not far from midway between the foot-hills and summit proper of the range.

This suite of rocks has been tapped in many points, and a highly remunerative business is now conducted in preparing lime for the market, and its finer qualities for ornamental architecture. This formation is capable of producing varieties of marble that it will be difficult to excel from almost any part of the world. The town of Volcano, Calaveras county, affords a wide field for operation in this branch, and the beauty of the Ringgold marble requires no comment at this time.

There are many other places, too numerous to mention, in which a profitable business can and will be conducted in this branch of industry. Some portions of the more northern sections contain this rock in quantities sufficient for all the probable prospective wants of these sections. It is found in the Yubas, near the Slate range, and on the Feather River near the Rich Bar, and Sucker Ripple; and also in other localities in these districts. The Salmon, and other streams in the extreme north, also furnish it.

The southern district contains also a very recent conglomerate, the disturbance of which was, probably, attributable to the more recent convulsions that have been in action in these sections. It possesses but little interest, further than the testimony it may furnish, in a scientific view, in elucidating the early and later history of this portion of the continent; it will, therefore, be dismissed with this brief allusion.

Recent Sandstone.—Between the Merced and Tuolumne rivers there exists a bed of recent sandstone, which is, probably, nearly or quite contemporaneous with the last named conglomerate. This formation underlies the principal portion of the ground between those two rivers for a long distance to the west, hence during the rainy season this district is much more firm and dry, and it is a point eagerly sought for by the teamsters at this season, and for the most obvious of reasons. It finds a place in this report more for the purpose of illustration, than otherwise, and also as a recuperative agent for some points of the adjoining districts, to be spoken of under the head of agriculture.

In review of the subject before us, we find that there are evidences of at least three successive periods in which this portion of the continent has been involved, the three periods of upheaval being interrupted by long periods of repose.

In the *second* upheaval the larger portion of the extreme northern district was developed, which was, probably, nearly contemporaneous with the development of the south. A long interval of equiescence is here manifest, during which the land became inhabited by mammals of varied species.

In the *third*, we find that these species were obliterated, and their remains lie buried beneath the evident causes of their destruction.

Fourth. The granite appears to have been the first of the volcanic group, and that it broke through the slate. The other trapean rocks appearing within the latter part of the first period.

Fifth. The older granite appears disturbed by more recent rocks, as well also as by more recent granites of the same species. In this particular the granite suite resembles the Heidelberg, presenting three distinct veins of different ages.

Sixth. The serpentine rocks—many of them appear to have been cotemporaneous with the second period of disturbance, as is shown by their cutting through the older rocks.

Seventh. We are led to infer from the manner in which the trapean, and other volcanic rocks, have forced their way through the sedimentary formations, that these rocks must prove metalliferous, as analogy and experience have proved in other parts of the world. Time will not permit to discuss the local geology of the State in a separate and distinct subject; it will, therefore, be considered under the head of mining resources, which we shall now attempt to elucidate.

MINING RESOURCES.

Under this head will be included all those branches of employment within the district alluded to, as well also as those which must, from the nature of attendant circumstances, find a place in the history of our resources.

First in order will be the mineral lands, or those which contain gold. These will be divided into two classes: First—Those at present occupied; and Second—Those unoccupied, and, from present circumstances, unavailable.

The first class comprehends all those lands within the mountain districts which are situated on the rivers and higher valleys, also in the ravines and mountain gorges of the western flank of the range.

The range that they occupy through the country may be approximately stated to be not far from fifty miles in breadth by about three hundred and fifty in length; a small proportion of this, however, can be considered mining ground—probably about one-third. Within the mining districts proper there are large quantities of land which are known to contain gold, and in quantities sufficient to warrant considerable expenditure of capital for the purposes of mining in future. These lands are not, at the present moment, available, from the want of that necessary agent, water; and it remains but to be seen that capital investments in hydraulic operations in this country is a safe and profitable source of income, and the unemployed moneys of the Atlantic States, Europe, and our own State, will seek and find a ready market in the various branches to which this source of profit will give rise. A longer period than the present year will not be required to demonstrate this fact, either for good or ill. The present year will be productive of results that cannot fail to convince the most incredulous of the value of those untouched resources of which it has been our pride to boast, and in the full consciousness of truth. Nearly all those companies that are at present in but partial operation, have demonstrated the utility of the system; and from what we have already seen, even in their immature state, we may confidently anticipate what the future will be, when those operations arrive at completion. Should they prove of one-half the value they now promise, the area within the mineral districts proper that would be open to those operations, now unemployed and useless from the want of water, and which are known to contain gold in profitable quantities, will nearly equal the present area employed.

It will require then, on these premises, no great tension of the imagina-

tion to discern, that within the next two years our mining sections must contain a population full one-half greater than they at present occupy. This estimate is exclusive of those discoveries which have been made within the last six months, and which only confirm the opinion formerly entertained, that the placers existed in sections remote from those now known. These later discoveries are situated mostly in the northern district, and the only obstacle presented to their profitable occupancy is large numbers of hostile Indians in these vicinities, particularly in and about the regions of Pitt river. It will be sufficient to state, that the unoccupied placers within the mineral districts proper are co-extensive with the mineral range now occupied. This unoccupied mineral land may properly be divided into two distinct sections, and to this second section we would now call your attention.

SECOND SECTION.

This district of county is situated in the lower foot-hills, and immediately on the eastern edge of the valley, it maintains a very uniform width of about four miles, and is almost uninterrupted throughout the principal portion of the valley district. A large part of the mineral section of Sacramento County is a true example of these sections, though the principal range alluded to is a short distance west of those parts in which mining operations are conducted in this county at the present time.

This district is strongly marked throughout its entire extent, and the transition either from the valley or mineral district proper is such as cannot fail to attract the attention of the most careless traveller in passing over it. It will recur to the mind of every one who has passed from the rivers to the interior, that at the distance of some twelve or fourteen miles from the streams, that you enter very suddenly a district thickly covered with *angular* pebbles of quartz; the district is scarcely less than two miles in width in any part of it, and in some localities much wider. On reaching the eastern verge of the valley, the transition is equally sudden as in the first instance; the *angular* pebbles disappear, and a few round pebbles, mixed with alluvion, replace them, for a short distance, which is immediately succeeded by the outcrop of what has been denominated the "*gravestone*" slate, from the appearance they present of a ruined churchyard, in nearly all the lower hills on the eastern edge of the valley. From what the author has seen of this district, I feel no hesitancy in saying that it must in a few years become the field of busy and extensive mining; and I think this opinion will meet the concurrence of those persons who are intimately acquainted with the localities named, and engaged in these operations at the present time within their limits, although these operations are comparatively limited at present. Rhodes' Diggings, Sacramento County, and Ousley's Bar, Yuba County, are on the eastern verge of this range, and Neal's Diggings, on Butte Creek, Butte County, also, and to those who are acquainted with these localities we would respectfully submit the opinion advanced.

It is not to be understood that this section of country will prove so highly productive in a short space of time as the more superficial and richer deposits of the interior sections, nor can it be with any degree of propriety expected. But as a compensatory principle they will possess the double advantage of being much more accessible and yielding a lower but far more continued re-

muneration for labor, and a surer prospect of success. A more healthy and stable condition of the mining population will be the result of bringing these lands into successful operation; a desideratum much desired in this country.

QUARTZ MINING.

This subject will next claim our attention, and our brevity on the subject will be found in our limited time.

In speaking of the rocks that compose our mountains, this formation was intentionally omitted, and a brief description of this group, therefore, will be given at this time. The quartz formation forms an important point in the various groups that abound in this country; not so much in proportion of its masses, as they are small when compared with almost any other member of the plutonic series. The comparative range of country which they pass through cannot be considered as amounting to more than one twelfth (1-12) of the width of the mountain range. The area that it occupies is also very small, compared to the rocks they pass through, being composed of small veins and dikes, cutting other formations, both igneous and sedimentary. The largest masses of the rock is found in the form known as *dikes*, which are at times nearly continuous above the surface for miles, in other cases interrupted on the surface at short distances. The largest dike ever observed by the author did not exceed forty yards in width, while the principal formation adjacent, and through which it passed, was nearly as many miles. It must not be understood by this that the amount of its aggregate is trifling, except in a comparative view to other formations, for its veins are found in most of the other rocks of the country, and as variable in size as in numbers.

The rocks throughout the country present many and distinct phases. On close examination they are found to be a disturbing and intrusive rock, while in other cases a feature the reverse is presented, they being disturbed by other rocks; and still another feature is often present, and frequently in the same locality; thus it is, that some veins appear to have been unaffected, while adjacent veins are much disturbed and broken down.

With these premises before us, it would seem impossible to refer the entire group to one period, for the facts presented would remain unexplained, while many of the attendant discrepancies that have attached themselves to those operations which have resulted in loss and disappointment to the adventurers in this branch of mining, will in a great measure be found referable to these probable differences in the ages of these rocks.

I flatter myself that this opinion will be sustained ultimately, if not at present, by the community at large, and by scientific miners of other countries, as well as by subsequent examinations in this country.

The opinion that all metallic veins are referable to one age, which was formerly entertained in England, is fast losing ground before the march of scientific research, and the practical miners of this country now study the relative age of the formation, and form their estimates of its value very much on this basis.

It is found that there are eight distinct series of veins in some of the mining districts of England, and that these veins vary in value according to their relative age and position. It is made a practical point of examination be-

fore entering on mining speculations in this country, to ascertain the relative age of a metallic vein before entering in the enterprise of extensive operations. We would, therefore, suggest the following proposition in relation to the auriferous veins of this country.

That the value of these veins will be found in the relative age which they maintain to the rocks with which they are found in connection, being modified as their passage is found to be through igneous or sedimentary rocks.

This suggestion is made, in the hope that less disappointment may be experienced by those who seek a profitable and laudable employment in those branches of industry, and also to check, in some measure, those hasty and inconsiderate generalizations that once promised to blast the most brilliant prospects of the State. Two years since, this opinion was maintained and also made public, and the estimate then made of the probable fate of a large portion of those who had embarked in these speculations was predicated, in part, on these grounds. How far that prognosis has proved true, the public can best judge. Another, and an important point in this subject, is the association of the metal with other minerals in the vein. A large portion of the gold in these veins is frequently combined with other minerals, most of which are of a compound character—as the oxides of iron, and also its sulphurets, (pyrites).

It must be seen then, that one general and indiscriminate treatment of ores must not only prove annoying in the results that are obtained, but highly disastrous in the extraction of the metal, for the process that would relieve the metal in one case, would only serve to fix its investing matrix more closely in the other. Hence has arisen much of the discredit to this branch of mining and pecuniary losses. This has been sustained from the neglect in making the necessary selections of ores from the same vein, and applying the same treatment for each variety. The experience in this branch of mining of the past eighteen months, has demonstrated too truly and sadly that those methods heretofore adopted cannot be pursued with profit, but on the contrary, that certain loss must be the result of this system, too hastily entered upon, and too thoughtlessly pursued in whatever branches of industry it may be applied.

But from the failure that has been experienced in this case, it would be unjust ever to infer that these metallic rocks do not possess the equivalents of wealth that a reasonable estimate has placed upon them, by men whose judgments have been unbiassed and unswerved by the over-heated infatuation that has too often prevailed here, and elsewhere, in relation to this subject. The best proofs of fast returning confidence in these richest of our resources, is found in the large amounts of foreign and home capital that is now seeking opportunity of investment in them, showing most clearly, that the denouncements that have been piled upon them were based upon false premises, and are so considered abroad. In addition to this, a local demonstration goes to support this position, and exerts a wide spread influence, which serves to give weight to the above. It is known that parties who have suffered severe losses by embarking in these operations, still feel confident of success, and still hold those veins, feeling fully assured of their real value, although with their present means they are unable to proceed at the present time with success.

There are but few of these veins that can be purchased from the original

holders, for anything like moderate prices, and those that are in second hands, are equally firm. No true barometer of public opinion can be found of their value than is indicated even under such apparently depressed circumstances.

The next metal that will engage our attention is

PLATINUM.

This metal appears as widely distributed as gold, there is scarcely a section of the country, in which gold has been found, but that this metal also has been discovered. This fact would lead us to suppose, that from the commercial value of the metal in its crude State, being about one half that of gold, that it may at some future day be sought for, as an article of commercial export, among the exhausted placers of the country. It is to be regretted that a more intimate acquaintance with this metal, among those engaged in the mining districts, does not exist, as I feel fully confident that the value of our mines would be enhanced nearly 25 per cent. by its collection.

A description of the metal would not lead to its detection, as it is so frequently combined with other minerals that closely resemble it, and would be easily overlooked. We shall, therefore, dismiss it by noticing the localities where it has been observed.

It occurs on Salmon river, in the drift that contains the gold, in small round grains of a steel-grey; also on the South Fork of the Trinity about eight miles from its junctions. On Butte Creek, near Reeves' Bar: On Honcut Creek, imbedded in gold, between the North and South Forks, and also in the placers between there and Feather river. On Cañon Creek of Butte County; on Middle Fork of American river; on Calaveras river associated with small garnets in the drift; on Wood's Creek; at Gold Flat, Nevada, with iridium and osmium, and small crystals of rutile at the bottom of the shafts.

This wide dispersion of this metal, through this country, would indicate that at some future day it may be made a source of profit.

SILVER.

This metal has been found in several of the mines that have been opened in this State, all of them, thus far, situated in the southern district. It was first met with in a distinct vein, running parallel with a vein of gold, in the South Carolina mine, at Carson Hill. At this place I obtained a fine specimen. I was informed of its being found in the Old Dominion mine, beside the above, and north of it, and also in the Relief Mine, south of it. The New York Mining Company, on the opposite side of the river at Eagle Hill, was the next in which it made its appearance. At the Chilean Mine, two miles north Columbia, it occurs, associated with copper and gold in quartz in the form of sulphuret; also Frazer's mine, twelve miles east of Sonora, with galena and zinc-blende in the same rock. At these localities it is generally disseminated through the quartz.

At the Washington and Georgia mine, Quartzburg, in Mariposa County, I observed this metal in the form of ruby-blende in the vein-stone containing the gold, and when the metallic gold appeared, it was a little lighter in color than common evidently from a slight alloy of the two metals.

This metal in other countries has proved a great and important source of wealth. From its casual occurrence in our mines, and its evident tendency of increase, as you advance south from the Stanislaus, there is just reason to hope that it may, in this country, become the source of wealth and profit.

COPPER.

This metal is much more widely distributed than the silver, through the western flank of the range. Commencing on the extreme north, it is found on the North Fork of the Trinity, a short distance from its confluence with the main stream, in a metallic state, in crystals and masses. The vein cuts both sides of the river, but its entire extent is not known. Vitreous copper is found adjoining, and also malachite. It occurs on both the Middle and South forks of Feather river, in the form of carbonate; also between Nevada and Grass Valley, near the Half-way House, and in many parts of the southern mines. I cannot speak with certainty in respect to the ores of this metal in the coast range, having never seen them; but judging from the character of the ores which have been brought from there, we feel warranted in believing that it exists in large quantities, but subsequent exploration must alone determine this point. The varieties of ore which we have seen from these sections, are of that character that would make their reduction easy, if they exist in sufficient quantities to warrant investment.

CHROMIUM.

I would invite your attention particularly to the ores of this metal, inasmuch as from its appearance in large quantities in some sections of the State, and the extensive distribution of the serpentine rocks to which it is also incident, we may expect, with a great degree of confidence, that it will be largely developed within our borders. It is an article of great commercial importance throughout the civilized world. Its principal use in the arts, is for the coloring of porcelain, dyeing, and as a pigment. The fine chrome yellow so highly prized, is manufactured from this mineral. Nearly all the chrome used in the world, is produced from the mines of the United States. The Shetland Isles producing the next largest amount. The principle locality, and we might say nearly the only one on the Atlantic border from which this mineral is derived, is at the *Bare Hills* near Baltimore, and this affords the supply of the world.

The greatest amount that can be obtained from all sources at present known, is about 2000 tons, though the market would consume a much larger amount could it be obtained. From the limited supply in the market, the public will, at no distant day, be directed to its development in this State. So soon as cheap and rapid means of communication is obtained with the interior of the State, this ore will probably become an article of export to a

large extent, to China, and the Atlantic States, and England. It would be unnecessary to make it an article of export even, unless its reduction would prove too expensive in this State, on account of the high price of labor, for ample material usually exists in its vicinity for this purpose.

The high prices of the various manufactures from this mineral cannot fail to attract attention to its further development; and I feel that the value of the mineral will be sustained, when we say, that its market price in the state of rough ore, will equal the product of our best ores of gold in their average, being about \$80 per ton. It has maintained this price very uniformly for a number of years.

This mineral is found in veins and masses running through serpentine rocks. These masses are often large, weighing from 60 to 80 pounds, and smaller, and generally disseminated through the rock and upon its surface.

The finest specimens the author has ever seen, have been found in this country, and in some localities in large quantities. A striking feature in the country that abounds in this mineral, among the serpentine formations, is the peculiar bareness of the immediate district compared to other surrounding sections, and an individual once observing it, would scarcely fail to recognize its characteristics even at a considerable distance.

The principle localities that have been observed as abounding in this mineral, are upon Nelson Creek near its junction with Feather river, in fragmentary masses. On the ridge, between the North and Middle Forks of the American, in small fragments; on Bear river four miles above Anson's Ferry; in the Cayota Diggins, near Nevada; and on Deer Creek, two miles below the City of Nevada.

It is at this last named locality that its attendant peculiarities may be most conveniently studied. It occurs here in large amorphous masses of twenty to fifty pounds weight, scattered over a low range of hills of some four to six miles in extent. The mineral would be easily mistaken, by the passing traveller, for large fragments of some of the darker trap rocks, or dark porphyries.

It is very dense, and possesses a semi-metallic lustre. Rolled fragments are often found of considerable weight on the banks of the creek in the vicinity. My attention was first directed to this mineral by Mr. Henry Pratten, who is at the present time connected with the Geological State Survey of Illinois, and formerly of the Minnesota Survey, by the United States.

In what follows, relating to other minerals observed in my tour through the country, I shall confine myself to the principal ores only, and their localities, unassociated with their different varieties, as the limits of this report will not permit of more elaborate detail.

Commencing with the auriferous group. Among the auriferous rocks we find—

Talc—at Central Company Mine, Marthenas Creek.

Chlorite—Volcano Mine, Middle Fork, American.

Talc—Dry Creek, El Dorado County.

Chlorite—Angels.

Peroxide Iron—Coyote Mountains, Sonora.

Heavy Spar—Armagosa Mines, Desert.

Arsenical Pyrites—head of Bear river.

SILVER.

Argentiferous Galena,	Frazer's.
Zinc-Blende and Arsenic,	do.
Sulphuret Silver and Malachite,	Columbia.

MISCELLANEOUS.

Marble, white,	Ringgold.
do. clouded,	do.
do. variegated,	do.
do. jet,	do.
do. white,	Volcano.
Oxide of Iron and gold,	Frazer's.
Arsenical Pyrites,	do.
Foliated Graphite,	Amidor.
Marble,	Deer Creek.
Arsenical Pyrites in Argelite,	Eagle Hill.
Vitreous Copper,	Carson's Hill.
Silicate do.,	do.
Carbonate do.,	Columbia.
Franklinite,	Stanislaus River.
Jasper,	Volcano.
do.,	Talbot's Hill.
Carbonate Copper,	Round Tent.
do. do.,	Grass Valley.
Sienitic Granite,	" "
Augite do.,	Anson's, Bear River.
do. do.,	Auburn Creek.
Scoria,	Sugar Loaf, Nevada.
Sienite,	Half-way House.
Peroxide Iron,	Deer Creek.
Peroxide Manganese,	Deer Creek.
Cinnabar,	" "
"	Yuba River.
Petrifactions,	Talbot's Hill.
"	Nevada.
"	American River.
"	West Hill, Nevada.
Lignite,	Nevada.
Molybdenum,	"
Fossil Leaves,	"
" Lichens,	Wade's Creek.
Pitch Stone,	Sugar Loaf, Nevada.
" "	Double Springs.
Mammalian Fossils, <i>teeth</i> ,	Sonora.
" " "	Douglas's Flat.
" " "	Murphy's.
" " "	Vine Springs.

Fossil Shells, Miocene,	-	-	Butte Creek.
“ “ “	“	“	Chico.
Magnetic Iron,	-	-	El Dorado and Placer Co's.
Obsidian,	-	-	Butte County.
Peperino,	-	-	“ “
Emerald,	-	-	Vallicita.
Rock Salt,	-	-	Near Sonora.

Ossiferous Cavern on Wade's Creek, containing human bones, teeth of the Wild Boar, and other animals. There are other caverns of considerable extent in the calcareous formations of the State, but nothing peculiar was observed in them. Those visited, were Martin's Cave, Middle Fork American River; McKinney's, and Volcano, in Calaveras County.

MINERAL SPRINGS.

There are several mineral springs scattered through the country, consisting mostly of Chalybeate and Sulphur; they are widely dispersed—but a few of them will be noticed.

Chalybeate Spring, upon	-	-	Destruction River.
“ “ “	-	-	North Feather do.
“ “ “	-	-	“ Yuba, English Bar.
Sulphur Spring, at	-	-	Jackson, Calaveras County.

This last is the most important of all, and to be found in any quantity; it will probably become a place of resort for invalids in the future, as its waters are powerfully medicinal.

Valleys of Sacramento and San Joaquin.—Before noticing the probable capabilities of these valleys for Agriculture, so far as can be inferred from an examination of the rocks on their eastern and western borders, we will consider the probable formations that under-lie those valleys.

To Mr. Tyson we are much indebted in demonstrating these formations, and his opinions are entitled to our confidence in this particular, as his observations in other parts of the country have been verified by different scientific travellers.

Of its agricultural prospects, he said, “unless ample supplies of water can be elevated to the surface, it can never obtain much importance for purposes of agriculture.”

It was, therefore, important to ascertain whether the geological structure beneath would warrant the expectation of bringing water above the surface by means of Artesian wells, and I do not hesitate to say it does most strongly. “Experience has demonstrated the almost certainty of obtaining water by this means in all valleys resting on sedimentary formations, and having a basin-shaped stratification, the beds of which are not too compact to prevent the passage of water through them, or between.” He further observes: “That these indications are fulfilled in these valleys, and that we have sufficient evidence that the beds of conglomerate, sandstone and clay

that dip under the eastern edge of the valleys, is the same which rise from it on the west."

This correct and lucid description of the structure of these districts, cannot but lead us to the conclusion, that water, in quantities sufficient for purposes of agriculture, is obtainable from these sources, and at comparatively low rates. But a few years will elapse before this method will be adopted on an extensive scale. It needs but the initiative to bring this mode of irrigation into general use, and it will soon be largely employed.

This is demonstrated in the sinking of wells in the city of San Francisco; notwithstanding the failure of the first experiment in that city, there are a large number of these wells now in operation and others contracted for; and if proof of the possibility of the operation is requisite, these practical illustrations we think are sufficient, being situated as they are in a district where the probabilities of success were much less flattering than any part of the great valleys present. The adoption of this method of supply for this needful agent in the arid portions of the valleys, cannot fail to increase the resources of wealth which are the *right arms* of national prosperity; and it would seem then to become a question of economic interest with the State to take the first step in some of the valley counties, or in a more indirect manner through these counties to demonstrate its practicability in those extensive and now useless districts alluded to. The benefits that would result to the community from its success must prove prodigious, and its expense a mere trifle compared to the advantages.

Should this suggestion meet with your approval, the author would venture to propose three points distant from each other on which the experiment might be tried, with the above object in view, and which would sufficiently illustrate the practicability of the system for all parts of the country.

The localities best suited for these operations, in the author's opinion, would be—

First: Near the line of Colusa and Yolo Counties, at a point a few miles east of the foot-hills of the coast range. In Sacramento County, midway between the American and Cosumnes rivers, at a point five miles west of the valley foot-hills; and in Tuolumne County, on the same range, eight or ten miles northwest of Jackson's Ferry.

This last named point is one of considerable importance, as a recent sandstone formation exists, overlaying the older rocks, directly below which water would probably be found.

The localities named are situated in the more arid portions of the valley districts, and are therefore selected.

MODIFICATIONS OF SOIL ON THE VALLEYS.

The capabilities of a soil for production in agriculture is dependant, in most cases, in an equal or proportionate distribution of the minerals comprising it, and an excess of any one of its basic ingredients will render it unfit for these purposes, to which it would otherwise be well adapted.

On page 15, allusion was made to this point when speaking of the preponderance of the argelite formations and of the influence they must exert from

the large amount of their debris being commingled with the major portions of the alluvial of the valleys.

Hence it follows that a large portion of the lower prairie of the great valleys contain a notable and even disproportionate amount of this argillaceous ingredient, the natural and corrective agent of which is the sand and sandstone formations, so widely distributed in most parts of the country.

The application of this agent as a subsoil, or its mixture with the heavy argillaceous earths, will have a tendency to make them much more manageable and prolific. It is well understood that a goodly amount of lime is a most necessary ingredient in all soils in which wheat is to be raised, the more especially if followed for several consecutive years. In the more northern sections, this mineral does not hold so important a place as a distinct deposit as we have seen it to be in the southern districts; and although this cereal may flourish well at this time at the north, we must not place too implicit confidence in the capabilities of our soils, in this particular, for too long a period, without applying artificially the necessary calcareous matter that will by successive sowing become exhausted.

The southern district will not suffer in this particular on those lands that will produce this grain, from the fact that much higher amount of calcareous earth is commingled with the alluvial of the valleys, and the formation is much more extensively developed in these sections.

In addition to this, the disintegrated sandstone of a large portion of the lower part of the rivers that flow through these sections is calcareous, so much so as to effervesce with dilute acids. This sand and sandstone will be used for purposes of reclamation on the heavy argillaceous earths incident to this district, as well as in the northern sections; and its closer proximity to the localities in which it will be needed, will render it more valuable.

This sandstone is of the same age as that in the vicinity of Benicia and the shores of Carquinez Straits, and adjoining bays; and if required, is well adapted for building purposes in those sections; and like the Benicia stone, it possesses the property of becoming more compact on exposure to atmospheric action.

The most convenient locality for obtaining this stone for any purpose that may be required, is about ten miles above Jackson's Ferry, on the Tuolumne road. At this place it joins the banks of the river, in bluffs full one hundred feet in height, which are perpendicular.

Formation of the Valley of the Sacramento.—Many and diversified opinions have been entertained relative to the formation of this section of the State, and it may yet be considered a questionable point, in some particulars, as to the causes which were productive of this result. The lake and river theory has its advocates, while others, and with more consistency, adopt the doctrine of gradual elevation from subterranean forces. In viewing the present portion of the valley and the sedimentary rocks that form its border, and the extensive area they occupy in the State, it appears conclusive that other agents than those of water must have played an important part in giving to the section its present character and appearance.

Were there no other portions of the country involved in this question than the upper and lower prairies of the valleys proper, the doctrines of

aqueous denudation might perhaps be sufficient to explain their present features in some degree.

An insuperable objection is offered to the lake and river theory in the formation of these valleys in the terraced form they present, from this fact: they must suppose a sudden and an abrupt elevation in the first place, to form the necessary lake; and in the second case, the contained waters should be moving or running waters in order to accommodate the necessary amount of alluvial, of which the valleys are composed.

Two conditions, as we see, that are inconsistent with each other, from the nature of the circumstances.

"And how long," asks Mr. Dana, "would such lakes exist after an elevation?"

If the violence of the elevation did not open for them a passage, the accumulation of water during a single flood would break a passage through such a barrier as the soft sandstone at the mouths of the Sacramento presents.

The inconsistency then of this supposition will be apparent, were there no objections of a different nature present. The barrier theory must have acted in such a manner as to have inclined the strata of the sedimentary rocks in this vicinity at a very considerable angle, had it occurred, this being the result of forces from beneath; and as we find that these formations are but very slightly disturbed or changed in their characters, we are not warranted in adopting this position, as an examination of raised beaches within five hundred yards of this capital will illustrate.*

The terraced form of the great valleys then are attributable to those causes which have been so clearly demonstrated by Mr. Dana, as having arisen from the process of gradual elevation by forces from beneath the surface, and which have raised the country some fifteen hundred feet since the tertiary epoch.

A careful examination will convince us that these forces are still in activity within the limits of this State, as recent examples have been presented in the last few months.

With this brief sketch of the general characteristics of the Geology of the State, and the short time allotted for the preparation of this, being but a few days, I hope will be sufficient excuse for its brevity. Did the time permit, a more elaborate detail would have been made, and which, at some future day, I hope I may be able to furnish, when the explorations now commenced shall have been completed.

Hoping the report may meet your approval and anticipations.

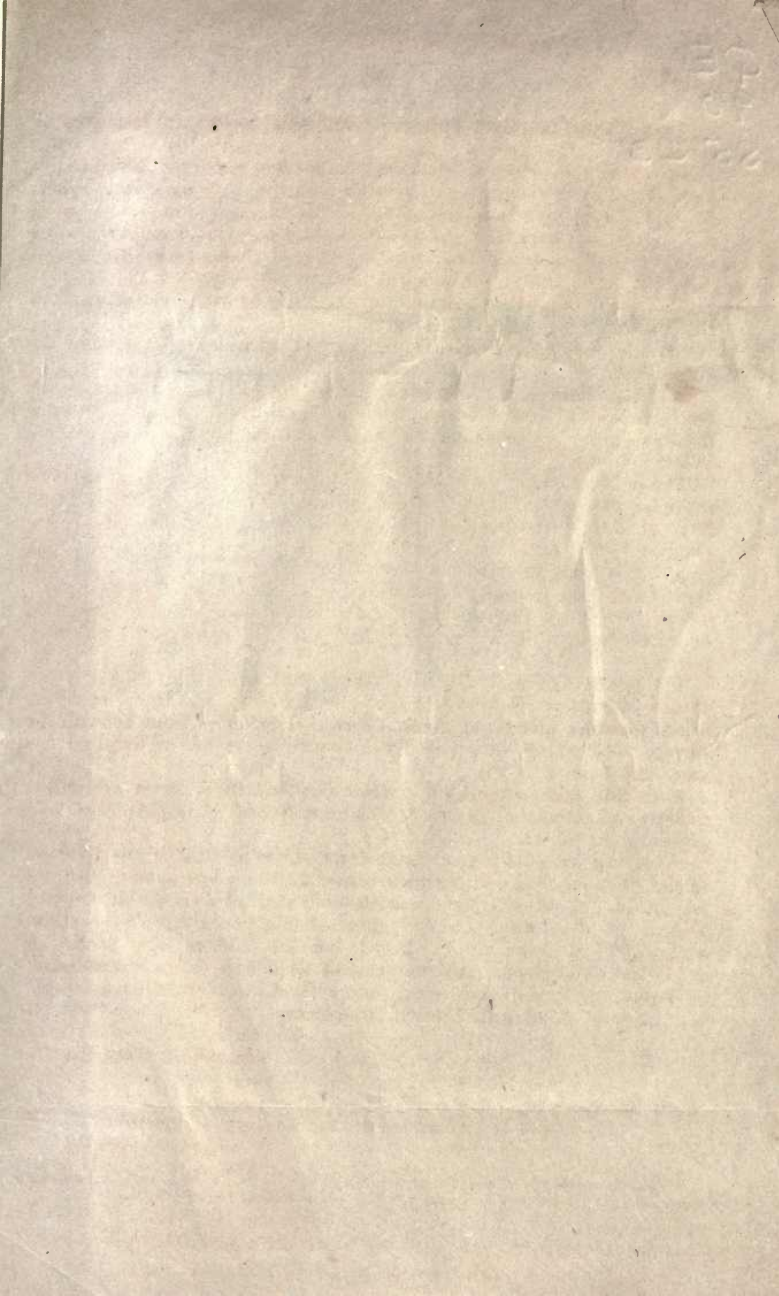
I subscribe myself, yours, &c.

JOHN B. TRASK.

To J. R. SNYDER,

Chairman of Committee on the Geology of the State.

* Since the above was written, I learn that Mr. J. Sheldon has in his possession fossil vertebrata and crustacea from this formation, which will be furnished at an early day.



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